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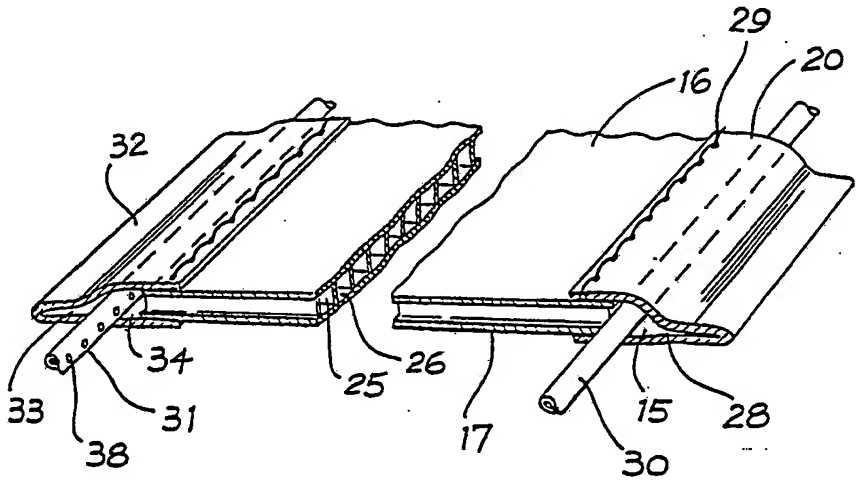

(57) Abstract

A floor mat and a container liner which incorporates the floor mat are disclosed for use in shipping containers that are used to transport compactable powders. The floor mat comprises: an upper planar non-flexible sheet (16) and a lower gas impermeable planar sheet (17) held in spaced apart superimposed relationship by a plurality of rigid ribs (25) which extend between the upper (16) and lower (17) planar sheets to form an array of channels (26) that extend substantially the full area of the floor mat, said channels being opened at one end and closed at the other; a gas manifold (28) having an upper portion and a lower portion each of which join respectively to the upper and lower planar sheets about the open ends of the channels in a manner so as to enable a flow of gas to be provided thereto; means to secure said floor mat to the container when in use; and wherein said upper planar sheet and said upper portion of the manifold have a plurality of micro-perforations.

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CONTAINER LINER

Technical Field

This invention relates to shipping containers used for the transport of materials in fine particulate form that readily compact, in particular, to a floor mat and a container liner incorporating the floor mat, for such containers to facilitate the discharge of these materials. The invention further relates to a method which uses either of the floor mat or the container liner to facilitate the discharge of such materials.

Background Art

There are many dry materials in fine particulate form which may have a strongly compacting nature, or are strongly binding, or are characterised by a steep angle of repose. These characteristics either singly or combined cause considerable difficulty in discharging these materials from a shipping container as they will not flow easily even when the container is tipped to an angle of say 45°.

As used in this specification the term "shipping container" and "container" refer to containers that are primarily used for road, rail and sea transport and are generally rectangular prismatic in shape.

Examples of fine particulate compactible materials include titanium dioxide, pigments, starch, flour and many chemicals.

Due to the number of materials falling into this category, the prior art is replete with proposals to facilitate the discharge of these materials from shipping and other forms of storage containers. Examples of relevant prior art are:-

US2943891 (Paton),
US3061379 (Lusted,
US2545766 (Cline),
US2919955 (Paton),

US2968425 (Paton),
US3231312 (Paton),
US2915337 (Loomis),
US3024072 (Hermanns) and
US3375042 (Ostberg).

In US2943891 (Paton) there is disclosed a fluidising or unloading floor mat to be placed on the bottom of a storage compartment in order to fluidise materials in small particulate form that are held in the storage compartment and thereby assist the flow of material out of the compartment. The floor mat comprises a bottom layer of gas - impervious material and an upper layer of gas - pervious material with the layers secured together at their periphery to form between them a distributing chamber. Means are provided to introduce gas into the chamber whereby the gas under pressure flows through the gas - pervious layer to fluidise the material stored above the mat. Fluidisation of the material assists its discharge.

In order to prevent the upper layer from billowing away from the lower layer, one or more substantially vertical webs may be used to connect the layers together to thereby form a number of compartments within the chamber. In place of webs, the layers may be sewn or glued together along spaced lines.

If all of the webs are provided with holes, a single source of gas may be used. It is, however, taught that when webs without holes are used, they form a series of independent chambers that may be separately supplied with gas. This is said to be desirable as it allows gas to be directed to selected portions thereby allowing for the selective fluidisation of material over that portion. It is further disclosed that whilst gas may be directly supplied to the distributing chamber, a preferred means is to provide each of the compartments with a pipe that

extends the length of the compartment. The pipe has a series of holes along its length so that gas entering a compartment is evenly distributed. The pipe also serves to keep at least a part of the upper layer apart from the lower layer at all times thereby providing an opening that allows some gas to enter the compartment when gas is first directed thereto.

Similar proposals to US2943891 are made by the same inventor in US2919955, US2968425 and US3231312.

In US3061379 (Lusted) there is disclosed an aerator pad for use in facilitating the discharge of pulverulent materials such as cement from bulk storage. The aerator pad is similar in constructions to the floor mat disclosed in the abovementioned U.S. patent although it is said to be normally limp and flexible thereby allowing the pad to be easily placed into a storage tank. Once in place, air under pressure is supplied to the pad to cause its inflation and then to pass through the gas pervious layer to fluidise the material held in the tank.

In US2545766 (Cline) again fluidisation is used to facilitate discharge but in this case, air is only supplied to the leading edge of the material.

In US2915337 (Loomis) it is taught that the bed of material is to be fluidised by an upward flow of gas which is then directed downwardly such that material is entrained in a gas suspension. The gas permeable deck used in this invention is said to be formed from medium woven fabric, porous metal or porous stone.

In US3024072 (Hermanns) there is disclosed an arrangement whereby aerating hoses extend longitudinally over the bottom of a container. At the end remote the discharge end, a transverse extending gas distribution means for the hoses is provided which is disposed at an angle greater than the angle of repose of the material held in the container. This arrangement is said to

improve the discharge of material that otherwise may be retained at the end remote to the discharge end owing to insufficient gas flow in this area.

In US3375042 (Ostberg), the disclosed cargo supporting floor is similar in principle to that disclosed in US2943891 (Paton) with the exception that the air distribution means used to fluidise the cargo comprises inflatable envelopes arranged transversely about a centrally longitudinally extending trough that includes a discharge opening. The envelopes slope towards the trough so that when inflated, material is not only fluidised, but directed downwardly toward the trough.

Although the prior art mentioned above provides means for facilitating the discharge of fine particulate compactible powders from storage containers, there are a number of practical disadvantages which the applicant believes have severely limited their commercial use. These are:-

(a) The fact that the flexible layers lie flat, the one upon the other during loading, storage and transport. Given the weight of cargo that lies on the mat, there is considerable resistance to the injection of gas between the layers and to its passage under the cargo.

(b) The existence of ridges between the pockets formed by the inflated mat, in which material is trapped and from which manual discharge is both difficult and costly.

(c) "Dead pockets" which exist at the junction of the flexible fluidising mat and the container walls in which additional material is trapped (for which discharge is both difficult and costly). This disadvantage can be overcome at some significant cost by extending the fluidising mat up the sides of the container or by adding extra fluidising panels to the

side of a container liner. However, apart from the disadvantage of the added costs involved, the additional panel will cause creases in the flexible-membrane mat which will inhibit the discharge of the final portion of the cargo.

(d) A major reduction in the effective width of the floor mat when inflated through injection of gas; up to one-third of the width is lost as the flexible membranes used form rounded gas tubes and pull away from the container's side walls. Although it is suggested that a restraining rope can be incorporated in the edge of the flexible fluidising mat and that this rope can be fastened to the floor and/or side walls of the container to largely overcome this problem, it is not practical. The added costs of the modification and of fastening and detaching the rope are high, and in any case shipping containers conventionally used for road, rail and sea transport do not normally contain suitable fixing points and shipping companies are normally opposed to modifying their general purpose containers in any way.

(e) Pervasive dusting caused by fluidisation of fine materials which, for environmental reasons, will normally make desirable the use of a full container liner (with top as well as bottom and sides) to fully enclose the cargo and of filtration equipment to minimise the effects and losses of dust.

It is an object of the present invention to meet the problems associated with discharging fine particulate compactible materials by providing a low cost floor mat, which may be easily installed into a shipping container, whereby such materials may be discharged completely and easily with minimal dusting, whilst being able to meet the varying needs of receivers of such materials.

Disclosure of Invention

Accordingly, in a first aspect the present invention consists in a floor mat for a shipping container which is useful for the transport of fine particulate compactible material, comprising

an upper planar non-flexible sheet and a lower gas impermeable planar sheet held in spaced apart superimposed relationship by a plurality of rigid ribs which extend between the upper and lower planar sheets to form an array of channels that extend substantially the full area of the floor mat, said channels being opened at one end and closed at the other;

a gas manifold having an upper portion and a lower portion each of which join respectively to the upper and lower planar sheets about the open ends of the channels in a manner so as to enable a flow of gas to be provided thereto;

means to secure said floor mat to the container when in use;

and wherein said upper planar sheet and said upper portion of the manifold have a plurality of micro-perforations.

In a second aspect, the present invention further consists in a container liner comprising a floor mat the periphery of which is surrounded by a collapsible web so as to form with the floor mat an enclosed space to contain a fine particulate compactible material, said floor mat comprising

an upper planar non-flexible sheet and a lower gas impermeable planar sheet held in spaced apart superimposed relationship by a plurality of rigid ribs which extend between the upper and lower planar sheets to form an array of channels that extend substantially the full area of the floor mat, said channels being opened at one end and closed at the other;

a gas manifold having an upper portion and a lower portion each of which join respectively to the upper and lower planar sheets about the open ends of the channels in a manner so as to enable the flow of gas to be provided thereto;

means to secure said floor mat to the container when in use;

and wherein said upper planar sheet and said upper portion of the manifold have a plurality of micro-perforations, said collapsible web having means to connect to the inside of a container so as to permit the web to be formed into upstanding walls when installed in a container.

In a third aspect the present invention still further consists in a method of discharging fine compactible material from a container comprising

fitting a container with the aforementioned floor mat or the aforementioned container liner;

filling said container with fine compactible material;

introducing a flow of gas into the floor mat at a pressure and a flow rate so as to sufficiently reduce forces between the powder particles and floor mat such that when the powder is tipped it will move towards a discharge outlet.

By providing a floor mat that has an upper sheet that is gas permeable by virtue of its micro-perforations but is non-flexible and planar the possibility of material becoming deposited in the spaces between the flexible compartments of the prior art floor mats is avoided.

Furthermore, the use of rigid ribs between the upper and lower sheets negates the need to provide adequate gas pressure to inflate the flexible compartments taught by the prior art. In fact relatively low gas pressures are preferably used which may be more readily and cheaply provided and reduce dusting.

A further advantage is that owing to the nature of the upper planar sheet, the floor mat can be walked on without damage which is certainly advantageous during installation. This is not necessarily possible in the case of the prior art inflated mats which of course could be readily punctured if walked upon.

A still further and the most significant advantage is that the loss of width of an inflated floor mat, described herein on page 6, does not occur in the floor mat of this invention as its dimensions remain substantially consistent irrespective of loading.

The upper and lower planar sheets are preferably formed from a synthetic plastics material, examples of which include polypropylene, polypropylene copolymer, high density polyethylene and low density polyethylene.

Particularly useful forms of planar sheets are those which are integrally formed with the ribs interposed therebetween. These forms are commercially available in a variety of extrusions and synthetic plastics material to yield a range of compressive strengths and other properties. Generically, they are referred to as double-skinned fluted sheets, examples including Corflute and Polyflute which are trade marks of Nylex Corporation Ltd., Fluteboard and Multiflute, which are trade marks of Corex Plastics Australia Pty. Ltd, and Printflute which is a trade mark of Mulford Plastics Pty. Ltd.

Corflute is one material that is particularly suitable and is available in a range of grades according to weight per square metre. Thus, 504gsm Corflute has a thickness of 2.95mm and a compressive strength of 153kPa which is achieved with average sheet thicknesses of 0.17mm and 0.20mm and 0.34mm thick ribs, arranged at 69 ribs per 400mm. By comparison 736 gsm Corflute has a thickness of 3.90mm and a compressive strength of 408kPa which is achieved with average sheet thicknesses of 0.23mm and

0.24mm and 0.42mm thick ribs arrayed at 69 ribs per 400mm.

It is also possible to obtain these double-skinned fluted sheets with ribs arrayed at 123 per 400mm. Multiflute is available in this form.

It will therefore be evident that given a particular material load requirement, such a suitable sheet material may be readily selected. Generally, however, the sheet material will have a compressive strength of not less than about 150kPa or a load yield of not less than about 7kg per cm^2.

Given the inherent strength and inertness of these sheet materials a floor mat or container liner of the invention made using these sheets may be used, cleaned as necessary and reused many times over.

Alternatively, for single use applications, the upper and lower planar sheets and ribs may be formed from a suitable strength cardboard material.

Preferably the ribs will be arrayed so as to extend transversely across the floor mat. In this way, the open ends of the channels will lie along one longitudinal peripheral edge of the mat whilst the other closed ends of the channel will lie along the opposing longitudinal peripheral edge. Using this arrangement, the mat may be mechanically creased in a number of suitably spaced apart transverse lines thus permitting the mat to be readily folded along these creases into a convenient shape for transport and storage pending reuse.

The upper planar sheet is micro-perforated, typically with holes of about 0.1 - 0.2mm diameter. These micro-perforations are preferably evenly distributed over the full area of the upper planar sheet so as to ensure even gas distribution over the full area of the mat. A rate of about 35,000 micro-perforations per square metre has been found to provide adequate gas permeability.

The microperforations may be introduced into the

upper planar sheet by puncturing using an appropriate diameter needle or other sharp instrument. This may be done using a sewing machine.

A gas manifold is provided to distribute gas under pressure to each of the channels. Preferably the manifold is formed from a flexible web, one end of which constituting an upper portion of a manifold is affixed to the upper planar sheet, whilst the opposing end of the web constituting a lower portion of a manifold is affixed to the lower planar sheet about the open ends of the channels. In this way, either of the two opposing openings formed by the other two ends of the web may be closed, with the other provided with a source of gas under pressure. By extending the web the full length of the planar sheets, all of the channels will be supplied with gas.

Conveniently, the end adjacent to the discharge end of the container will receive the gas.

The flexible web may be attached to the planar sheets by a variety of means of which the most preferred is by stitching.

In order to ensure that no space is available between the walls of the shipping container and the floor mat to thereby trap material being stored in the container, preferably the floor mat is dimensioned to substantially occupy the full area of the container. In this regard, the use of a flexible web to form the gas manifold is desirable as it allows for some variation in the internal dimensions of the shipping container which can vary somewhat depending on the container manufacturer. For guidance, the width of the planar sheets can be about 20-120mm less than the inside width of the shipping container.

Whilst the source of gas must be capable of delivering gas at greater than atmospheric pressure to the

floor mat, in order to avoid fluidisation of the bed of material in the container and the attendant dusting problems, a pressure in the range of about 13-35kPa (gauge pressure) will usually suffice. At such low pressures it is best to provide the gas using a blower at a flow rate of about 0.4-0.8m^3 of gas per minute per square metre.

It is however, possible to use compressed gas. In this case, it is preferred to provide a rigid pipe which is disposed longitudinally within the gas manifold with one end of the pipe closed and the other connected to the source of compressed gas. Along the length of the pipe are provided a series of 6-12mm holes. This pipe functions to reduce gas velocity and distribute the gas within the manifold. Generally, the pipe will not need to be as long as the manifold with a length of about 1 metre within the manifold being adequate.

To ensure that the floor mat is not discharged with the load of material when the container is tipped, it is desirable to provide means for retaining the floor mat within the container. One means comprises a pair of reinforced tapes adhered to the underside of the floor mat, each of which extends to one of the corners of the floor mat remote the discharge end. At each of these two corners is an eyelet attached to the floor mat and one of the tapes. Ropes are attached to the eyelets and tied back to internal lugs on the inside rear of a container's walls. Alternatively, a pocket may be formed at the edge of the floor mat remote the discharge end, a batten placed in the pocket and the batten affixed to the container floor by, for example, screws or nails.

Whilst the floor mat of the invention may be used to facilitate discharge of fine particulate compactible materials from shipping containers, the second aspect of the invention provides further utility in using the floor mat together with walls arrayed around the periphery of

the floor mat to form a container liner.

Use of such a liner in a container eliminates the possibility of the contained material becoming retained between the lower inner surface of the container wall and the edges of the floor mat. In addition, contact between the inner surface of the container and the contained material can be eliminated.

The collapsible web of the container liner which forms the walls is connected to the inside of the container in order to maintain them in an upstanding state. One means for achieving this connection is to provide eyeletted tags at the tops of the walls and attach these to lines which run along the upper portion of the inner surfaces of the shipping container.

In order to allow materials to be discharged, one or more outlets will be provided in the wall at the discharge end of the container liner.

Although the outlet(s) may vary widely in dimension to suit individual material and other requirements, it is desirable when the outlet is relatively small to provide directors within the container liner to direct the material flow to the outlet.

In one form, flow directors may be formed into the floor mat by mechanically creasing triangular portions of the mat at the outlet end. The triangular portions are folded upwardly with blocks being inserted between the floor of the container and underside of the triangular portions for support, thereby producing a chute-like shape. These blocks may be made from polyurethane, and the like. Alternatively, plywood sheets may be used in a wedge-like fashion to provide the requisite support. A still further way of forming flow directors is to cut out rather than crease a triangular portion. The triangular portions are then rejoined to the floor mat using flexible reinforced tape. In this way, the triangular portions can

be folded upwardly about the tape and supported in the same manner described above.

If a bulkhead is used at the discharge end of the shipping container, it may include discharge outlets and possibly loading inlets. A container liner of the invention may be provided with corresponding inlets and outlets to match those present in the bulkhead.

Although not essential to the invention in cases of for example excessive dusting, the container liner may have a top so as to completely enclose materials stored therein. This top may be provided with inlet(s) to allow loading of the container.

The collapsible web and the top of the liner will generally be formed from a suitable grade of synthetic plastic sheeting.

Connection of the collapsible web to the floor mat may be achieved for example by stitching whilst the liner top may be similarly connected to the collapsible web.

In some circumstances, such as when controlled discharge of material from a container is required, it is advantageous to provide means by which gas may be selectively directed to channels as required. For example, gas can be provided to the channels underlying the leading edge of the material which initially will be at the discharge end.

One means for achieving this end is by providing a second gas manifold in communication with a number of the channels, whereby this gas manifold functions to both close the channel and provide a flow of gas thereto when the manifold is connected to a source of gas under pressure. The second gas manifold will be located along the side of the floor mat opposite that of the first gas manifold.

Although the second gas manifold can be formed in like manner to the first gas manifold, preferably

a portion of the mat and/or liner wall will be removed at the point where they connect and a second gas manifold formed as the first gas manifold.

In circumstances where compressed gas is used, a longitudinally extending pipe may also be inserted into the second gas manifold in like manner to that described in respect to the first gas manifold.

In some circumstances, for example when there are restrictions as to the maximum angle a container may be tipped, it may be advantageous to include a false bottom between the floor mat and the floor of the container such that the floor mat slopes downwardly towards the discharge end. The false bottom may be formed using blocks of polyurethane, or an inflatable air bag, or other means to ensure adequate support.

In order to better understand the nature of the invention two embodiments of a container liner of the invention will be described with reference to the following drawings.

Brief Description of Drawings

Figure 1 is a partial cutaway perspective view of a first embodiment of the container liner of the invention;

Figure 2 is a sectional view about A-A of Figure 1;

Figure 3 is a side elevational view of a section of the floor mat of Figure 1;

Figure 4 is a sectional view about B-B of Figure 1;

Figure 5 is a sectional view of the pipe of the first and second gas manifolds of Figure 4;

Figure 6 is a partial cutaway perspective view of a second embodiment of the container liner of the invention; and

Figure 7 is a side elevational view of the floor mat of Figure 3 when folded.

Modes for Carrying out the Invention

The container liner 10 shown in Figure 1 comprises a

floor mat 13 which is stitched at its peripheral edges to a flexible web to form walls 11, 12. These walls are held in an upstanding state when fitted in a container by passing a tie line through eyelets 21 on the upper edge of the walls and connecting the tie line to tags mounted within the container towards its top.

As shown, the walls 11 extend to form the longitudinal sides of the container liner 10, whilst walls 12 disposed between walls 11 form the ends. For the sake of clarity, wall 12 forming the discharge end has been cutaway from Figure 1.

As is best seen in Figure 2, the floor mat is formed from upper and lower non-flexible planar sheets respectively 16 and 17. In Figure 3 these sheets 16, 17 can be seen to be spaced apart by ribs 25 which extend transversely in the floor mat to form channels 26. The channels 26 all are open along longitudinally extending peripheral edge 36.

Along its full length, the edge 36 has a gas manifold 28 connected thereto. The gas manifold 28 comprises a flexible web, which is folded in a manner such that one end is connected to sheet 16 whilst the other end is connected to sheet 17 to form a space 15 through which gas may flow. Both connections are made by a single line of stitching 29. As shown in the figures, the gas manifold is in an uninflated form.

Edge 39 adjacent edge 36 forms the leading edge at the discharge end. At the edge of the floor mat opposing edge 36, the channels 26 are closed by stitching 22, a web 23 over their openings. As shown in Figure 2, wall 11 is connected to the floor mat and web 23 by the same stitching.

The other wall 11 is, however, connected to the floor mat via the gas manifold 28. In this case, outer portion 18 of the gas manifold is stitched by a line of stitching

19 to the wall 11. In upper planar sheet 16 and upper portion 20 of the gas manifold are micro-perforations about 0.1-0.2mm in size.

As is best been in Figure 4, there is a second gas manifold 33 which is formed in like manner to manifold 28. A flexible web is folded in a manner such that one end is connected to sheet 16 whilst the other end is connected to sheet 17 to form a space 34 through which gas may flow. Both connections are made by stitching. As is evident from Figure 1 whilst gas manifold 28 extends the full length of the container liner, gas manifold 33 stands only a part way from the discharge to the closed end. The upper portion 32 of manifold 33 is micro-perforated.

In this embodiment, a source of compressed gas is used and hence longitudinally extending pipes 30, 31 are inserted into spaces 15, 34 of the two manifolds. As is shown in Figure 5, pipes 30, 31 includes a number of openings 38 along their lengths, both being closed by a cap 37 and provided with compressed gas through hose 35.

In Figure 6 there is shown a second embodiment of a container liner of the invention, generally designated as reference numeral 40. In this figure, those features the same as the first embodiment are referred to by the same numerals.

This embodiment principally differs from the first embodiment by being provided with flow directors 43. These are formed at the discharge end by mechanically creasing triangular portions of the floor mat and folding them upwardly to form a chute 44. Blocks of polyurethane 45 or plywood supports are placed on the floor of the container and the underside of the folded portions for support.

Through the use of the flow directors 43, pipes 41, 42 which provide gas respectively to the first and second gas manifolds, will normally curve to follow the slope of

the edge of the flow directors.

Towards the closed end of the container liner 40, on the underside of the floor mat are reinforced tapes 46 both of which extend from a point 48 to meet with eyelets 47 attached to the end of the floor mat remote the discharge end. Ropes, not shown, are attached to eyelets 47 and to the internal lugs of the container to secure the container liner therein.

In order to be able to conveniently store a liner when not in use, it may be readily folded as is shown in Figure 7. For the sake of clarity, the walls 11, 12 are not shown. In this case, the floor mat 12 has been folded about crease lines shown as 14 in Figure 1.

In use, the container line 10 is placed in a shipping container, the walls 11, 12 tied up using tags 21 and the liner secured by affixing tie lines between eyelet 48 and tags 47 in the container. Material is then loaded through the liner's open top or through inlets in the liner's discharge wall (not shown).

To discharge material, the container doors are opened, assuming that a bulkhead is used, and hoses 35 unfolded. The container discharge outlets are opened and the liner discharge outlets unfolded and/or untied, pulled through the container outlets and aligned with a receiving receptacle. The hose 35 is connected to source of compressed gas, the container is tipped to an initial angle of about 10^{o}, and the gas supply started. If desired, gas may be introduced into the second manifold 33 via a hose connection to pipe 31, prior to commencement of feeding gas into manifold 28.

A cushion of gas immediately forms beneath the material which commences to slide towards and out of the container.

Some bubbles of gas are visible as some of the gas finds its way up through the cargo, and when the cargo

level reduces to about 200mm some fluidisation takes place even at low gas pressure. However, it is possible to adjust gas pressure to minimise fluidisation and dusting. The container may be elevated to 30^{o}-45^{o} for final discharge, which is for all practical purposes complete, without significant residues remaining in the container. The mat/liner is then folded along pre-creased fold lines thereby enabling it to be transported and/or stored pending re-use.

Discharge of a container may be completed in 2-3 minutes if rapid discharge is acceptable, and is otherwise dependent on the size of discharge outlets, the capacity and shape of the receiving receptacle, the angle of tilt and whether a container liner or a floor mat is used.

Whilst this invention has been described with reference to certain embodiments these are to be construed as illustrative and not limiting to the scope of the invention as broadly described.

Industrial Applicability

This invention provides a floor mat for use in a shipping container and a container liner incorporating the floor mat. These are useful and have industrial application in the transport of bulk particulate compactible materials.

CLAIMS

1. A floor mat for a shipping container which is useful for the transport of fine particulate compactible material, comprising

an upper planar non-flexible sheet and a lower gas impermeable planar sheet held in spaced apart superimposed relationship by a plurality of rigid ribs which extend between the upper and lower planar sheets to form an array of channels that extend substantially the full area of the floor mat, said channels being opened at one end and closed at the other;

a gas manifold having an upper portion and a lower portion each of which join respectively to the upper and lower planar sheets about the open ends of the channels in a manner so as to enable a flow of gas to be provided thereto;

means to secure said floor mat to the container when in use;

and wherein said upper planar sheet and said upper portion of the manifold have a plurality of micro-perforations.

2. A floor mat as in claim 1 wherein the rigid ribs extend transversely across said mat.

3. A floor mat as in claim 1 or claim 2 wherein the upper and lower planar sheets and rigid ribs are integrally formed.

4. A floor mat as in claim 3 wherein the integrally formed upper and lower planar sheets and rigid ribs are formed from synthetic plastics material or cardboard.

5. A floor mat as in claim 4 wherein the integrally formed upper and lower planar sheets and rigid ribs are formed from synthetic plastics material.

6. A floor mat as in claim 5 wherein the integrally formed upper and lower planar sheets and rigid ribs have a compressive strength of not less than about 150kPa or load

yield of not less than about 7kg per cm^2.

7. A floor mat as in any one of claims 1 to 6 wherein the gas manifold comprises a flexible web, one end of which constituting an upper portion thereof is affixed to the upper planar sheet, whilst the opposing end of the web constituting a low portion thereof is affixed to the lower planar sheet about the open ends of the channels.

8. A floor mat as in claim 7 wherein the flexible web is closed at one end and adapted for connection to a source of gas under pressure at an opposing end.

9. A floor mat as in claim 8 wherein a rigid pipe is disposed longitudinally within the gas manifold, one end of the pipe being closed whilst the other end is adapted for connection to a source of compressed gas, said pipe having disposed along its length a series of holes.

10. A floor mat as in claim 9 wherein the pipe extends about one metre into the gas manifold and the holes are 6 to 12 mm in diameter.

11. A floor mat as in any one of claims 1 to 10 wherein the floor mat is dimensioned to substantially occupy at least the full area of the floor of the shipping container to which it is to be fitted.

12. A floor mat as in Claim 11 wherein the width of the planar sheets is 20 to 120mm less than the inside width of the shipping container.

13. A floor mat as in any one of claims 1 to 12 wherein the micro-perforations are about 0.1-0.2mm in diameter, at a rate of about 35,000 per square meter.

14. A floor mat as in any one of claims 1 to 13 wherein the planar sheets are mechanically creased so as to permit folding of said floor mat.

15. A container liner comprising a floor mat as claimed in any one of claims 1 to 14, the periphery of the floor mat being surrounded by a collapsible web so as to form with the floor mat an enclosed space to contain a fine

particulate compactible material, said collapsible web having means to connect to the inside of a container so as to permit the web to be formed into upstanding walls when installed in a container.

16. A container liner as in claim 15 wherein eyeletted tags are provided at the tops of the walls to permit connection to the inside of the container.

17. A container liner as in claim 15 or claim 16 wherein the collapsible web when formed into upstanding walls extends in a manner across the tops of said walls so as to form a top cover for said liner to reduce excessive dusting and contamination.

18. A container liner as in any one of claims 15 to 17 including one or more outlets and/or inlets in the walls.

19. A container liner as in claim 18 wherein flow directors are formed into the floor mat by mechanically creasing triangular portions of the mat adjacent an outlet, said portions being folded upwardly and supporting means placed thereunder when the container liner is disposed in a container, thereby producing a chute-like shape.

20. A container liner as in claim 18 wherein flow directors are formed into the floor mat by cutting out triangular portions of the mat adjacent an outlet, rejoining the triangular portions to the floor mat using flexible tape along the cut line, said portions being folded upwardly and supporting means placed thereunder when the container liner is disposed in a container, thereby producing a chute-like shape.

21. A container liner as in any one of claims 15 to 20 wherein a second gas manifold is provided along the longitudinal edge of the floor mat opposite to that of the other gas manifold, said second gas manifold functioning to both close the channels along the edge and provide a flow of gas thereto.

22. A container liner as in claim 21 wherein the second gas manifold is formed in like manner to the other gas

manifold with a section of the collapsible web and/or floor mat being removed at the point where they connect to accommodate said second gas manifold.

23. A container liner as in claim 22 wherein a rigid pipe is disposed longitudinally within the second gas manifold, one end of the pipe being closed whilst the other end is adapted for connection to a source of compressed gas, said pipe having disposed along its length a series of 6 to 12mm holes.

24. A method of discharging fine compactible material from a container comprising

fitting a container with a floor mat as claimed in any one of claims 1 to 14 or a container liner as claimed in any one of claims 15 to 23;

filling said container with fine compactible material;

introducing a flow of gas into the floor mat at a pressure and a flow rate so as to sufficiently reduce forces between the powder particles and floor mat such that when the powder is tipped it will move towards a discharge outlet.

25. A method as in claim 24 wherein gas is provided at a pressure of about 13-35kPa gauge pressure.

26. A method as in claim 24 or claim 25 wherein the gas is provided at a flow rate of about 0.4-0.8m^3 of gas per minute per square metre.

27. A method as in any one of claims 24 to 26, wherein the container is initially tipped to about 10^o, gas flow is commenced and the container then tipped at an angle up to 45^o.

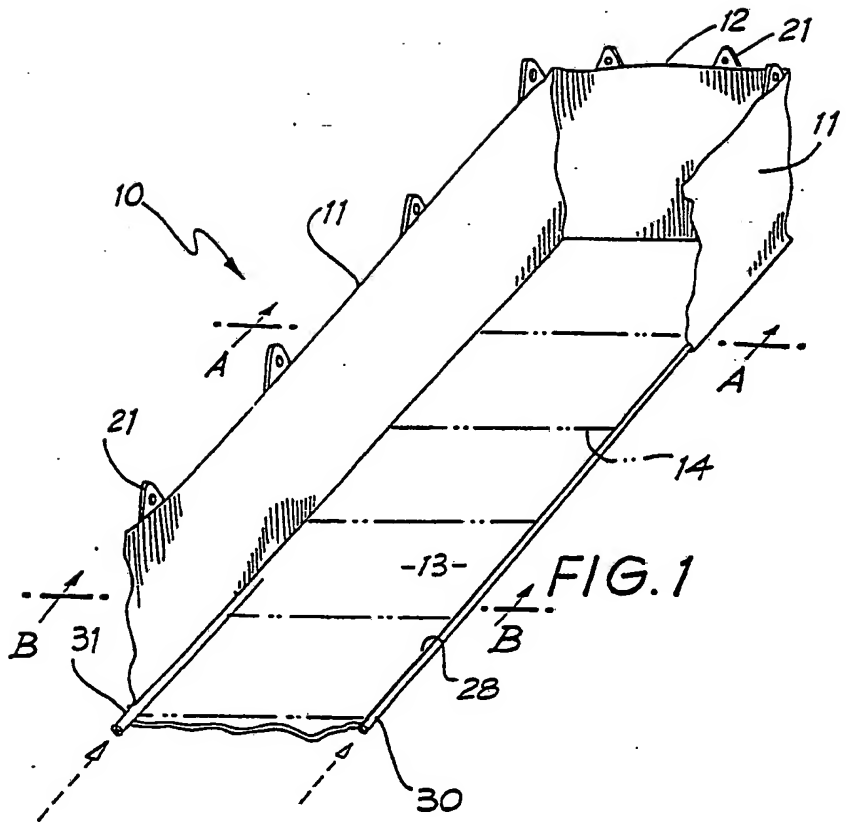
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FIG. 1

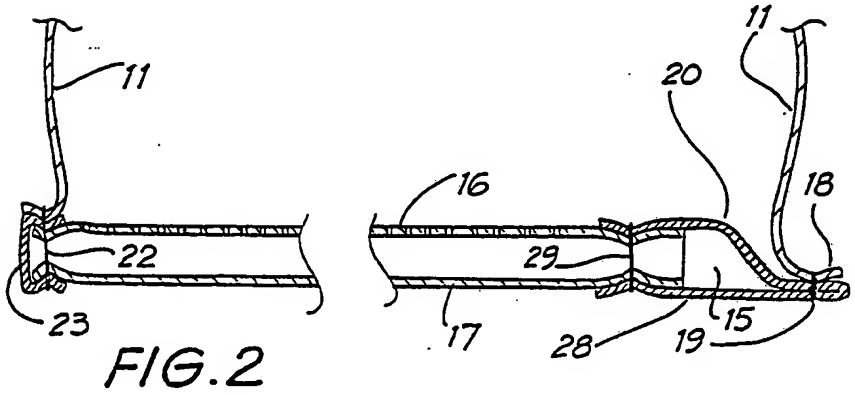
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FIG. 2

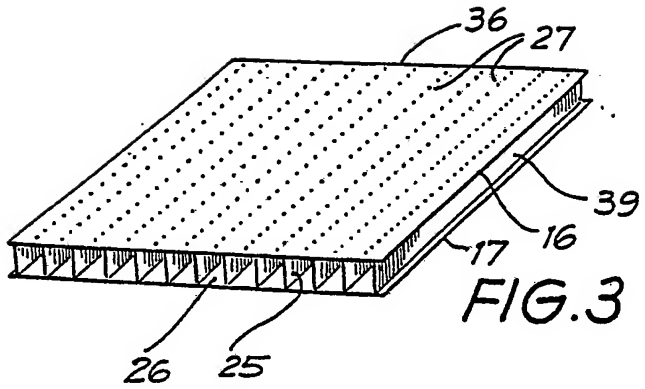

FIG.3

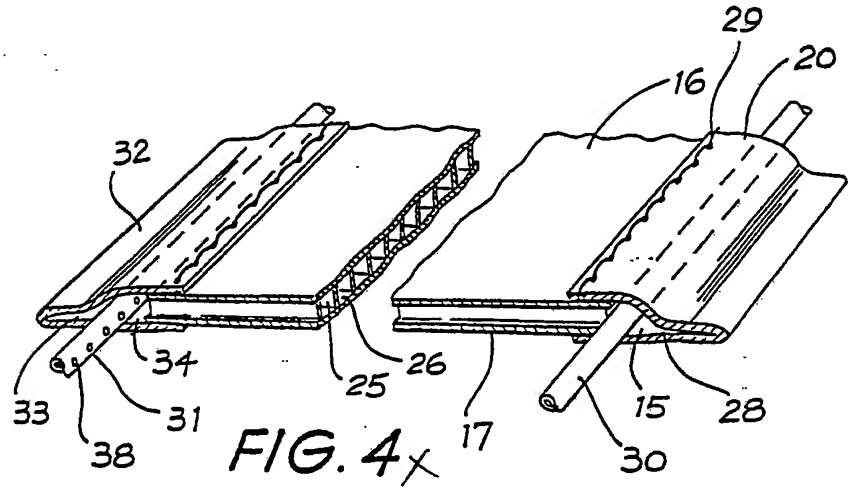

FIG. 4

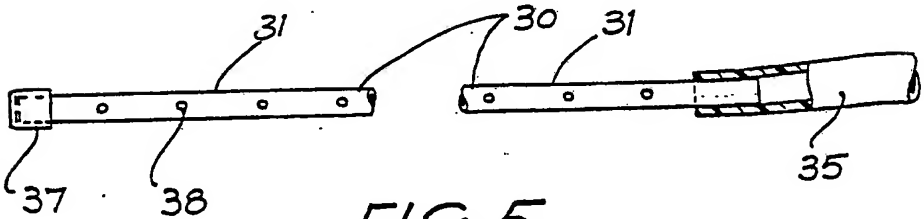

FIG. 5

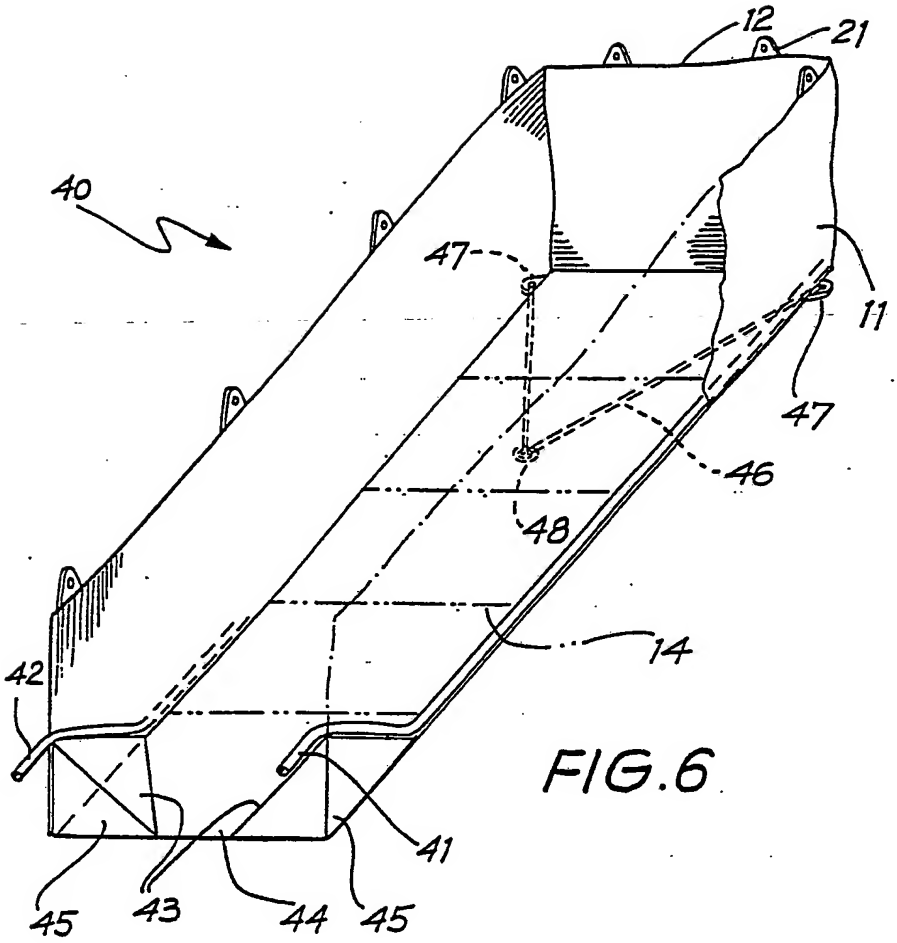

FIG.6

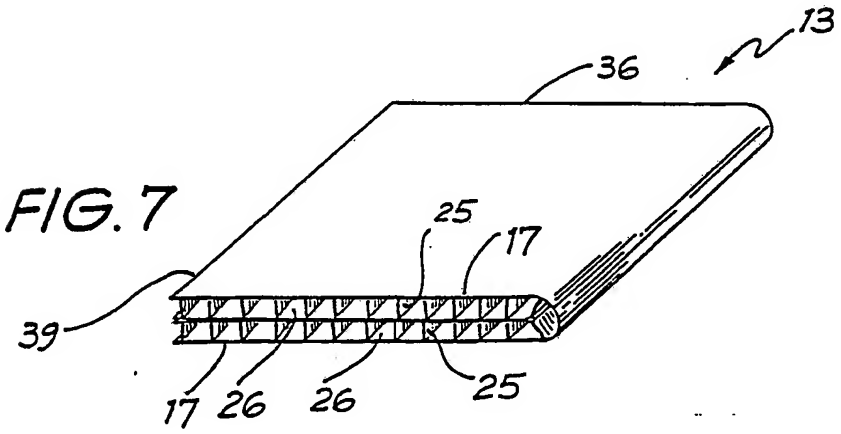

FIG. 7

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.[5] B65D 88/72, B65G 69/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC B65D 88/72, B65G 69/06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

AU: IPC as above

Electronic data base consulted during the international search (name of data base, and where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
	EP,A,0010182 (RUHRKOHLE AKTIENGESELLSCHAFT) 30 April 1980 (30.04.80)	
X	figure 2, figure 4	1-14,24-27
Y		23
Y		19,20
	US 3375042 (OSTBERG et al) 26 March 1968 (26.03.68)	
X	figure 4, figure 10	1-14,24-27
Y		19,20
Y	figure 4, figure 7	23

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 November 1992 (20.11.92)	2 Dec 1992 (02.12.92)

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
X	AU,B,24155/88 (601630) (AMATEK LTD) 4 May 1989 (04.05.89)	1-18,21,24-27
Y		23
Y		19,20
Y	WO 88/06560 (AGROINGENJÖR AB) 7 September 1988 (07.09.88) figure 7	19,20
A	US 2943891 (PATON, Hamilton Neil King) 5 July 1960 (05.07.60) whole document	1-27

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
EP	10182	DE	2843906				
AU	24155/88	US	4896706				
WO	8806560	AU	14236/88	DK	6099/88	EP	403471
		FI	885075	NO	884829	SE	8700896
		US	4993881				

END OF ANNEX